Comparison of the Insurance Loss Experience Of Unibody and Frame Construction Cars After a Collision Repair, 1981-82 Models

Highway Loss Data Institute

Highway Loss Data Institute
Insurance Special Report

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SUMMARY

This report compares the collision coverage loss experience of unibody and frame construction cars following a collision repair. The study was undertaken because concerns have been expressed that improper repairs of unibody cars have become common and, as a consequence, these cars are more likely to be involved in collisions following repairs. The study is based on the collision coverage loss results for 35 popular 1981 and 1982 passenger cars during their first three years of availability. Principal findings include the following:

- Collision coverage results for repaired 1981 and 1982 unibody models were no worse than the results for repaired 1981 and 1982 frame construction models.
- Comparisons of collision coverage results for unibody and frame construction vehicles showed no difference when grouped by the cost of the initial repair.

INTRODUCTION

The number of small cars in the U.S. automobile fleet has been growing substantially for several years. Traditional, large American made cars are built on frames, but for all recently built small cars, the body shell itself replaces the separate frame. This construction method is generally termed "unibody" construction. Although unibody construction is not new, there have recently been allegations that unibody cars are being improperly repaired in ways that could result in their being unsafe for subsequent use. These allegations center on the complexities involved in straightening and realigning a damaged unibody car. Many unibody cars incorporate a front-end suspension system that has very limited adjustment available to produce correct alignment. Consequently, it is important that a damaged car body be returned as closely as possible to its original dimensions in order to be able to correctly align the front-end suspension system. If a repaired car is improperly aligned, it may not steer and handle correctly, and this in turn could increase the chances that it would be involved in subsequent collisions. Concerns have been expressed that improper alignment of damaged unibody cars has become common and that these cars are unsafe.

The HLDI data provide the capability of examining the crash experience of cars after they have been repaired because of involvement in a prior collision. Using collision coverage claims data, it is possible to compare the experience of unibody and frame cars subsequent to collision and repair to see if their post-crash experience is different. However, there are still limitations in interpreting such comparisons because unibody and frame cars are of different sizes, and there is virtually no size overlap between the two types of cars. This complicates *any* comparison of unibody and frame cars because car size per se has been repeatedly shown to be a significant factor in insurance loss experience.

METHOD OF ANALYSIS

This study is based on the collision coverage loss experience of 35 popular 1981 and 1982 passenger cars.[1] The results were grouped by vehicle size (small, midsize, and large), body style (two-door, four-door, and sports and specialty), and type of construction (unibody and frame). The results were based on the collision coverage experience for the first three years of availability of the model years studied.

The unibody cars examined in this report are all small or midsize and frame cars are either midsize or large. Although the midsize group ot cars contains both unibody and frame cars, the unibody cars in this size class are smaller than the frame cars. Previous HLDI analyses have shown that small cars tend to have poor collision loss results and large cars tend to have better results. Because of the relation of size to collision losses, comparisons of results for the two construction types must be interpreted with caution.

Two sets of results were compiled for each of the two groups of cars: the collision loss experience for all cars and the loss experience for the subsets of cars that previously had a collision claim. This permits comparisons of the claim frequencies for repaired cars (i.e., cars with a previous collision claim) with the claim frequencies for the same type of cars without regard to whether they had had a previous claim. The following hypothetical example illustrates how these results can be used to examine this issue: Suppose that the claim frequency results for a group of repaired unibody and repaired frame vehicles were 15 and 10 (claims per 100 insured vehicle years of exposure), respectively. These hypothetical results show a 50 percent difference between the claim frequency for repaired unibody cars compared to frame cars; however, this difference may be simply because unibody cars are smaller than frame cars. Next suppose that claim frequencies were computed for *all* unibody and frame cars regardless of whether or not they had had a previous claim, and that these were 12 and 8 (claims per 100 insured vehicle years of exposure), respectively. These hypothetical results also show a 50 percent difference in claim frequencies; however, this may be due to size rather than construction type. The size effect can be removed by comparing the *increases* in claim frequencies for the repaired cars with the overall frequencies. In this hypothetical example, the increase in claim frequencies of repaired unibody compared to all unibody cars is 25 percent (15 versus 12). The increase is also 25 percent for frame cars (10 versus 8) suggesting, in this example, that any effect due to the prior repair was not different for the two construction types.

RESULTS AND DISCUSSION

Table 1 presents collision claim frequency results for those individual vehicle series with more than 1,000 insured vehicle years of exposure subsequent to their initial collision claim. The table shows the overall standardized claim frequency results for all cars and the percentage increases in standardized claim frequency results for those cars that were involved in a collision claim.[2] For the latter cars the results are based on the experience of the cars *after* their initial claim. This subsequent exposure was not computed until 30 days after the initial crash date to allow time for the required repairs to be completed.

The table provides the number of insured vehicle years of exposure for repaired cars only (i.e., cars with at least one prior claim) and combined claim frequency for 1981 and 1982 model year vehicles as reported in HLDI reports R83-2 and R84-2. Thus, these combined claim frequencies are based on the exposure for all vehicles (i.e., repaired vehicles

[1]See Appendix A for a list of the selected vehicle series.

[2]Results were standardized to eliminate effects due to operator age groups and deductible amounts. See Appendix B for standardizing weights.

plus those with no collision claim losses). The final three columns of Table 1 present percentage increases in collision claim frequencies for the repaired cars over the claim frequencies for all cars as a function of the cost of the initial repair. The cars that have been in a prior crash have a higher risk of subsequent claims experience than the overall experience for the same cars. The percentage increase in claim frequencies is given for all cars with at least one prior claim regardless of the amount, for repair claims greater than $500, and for repair claims greater than $1,000. Because there are fewer large claims, the amount of exposure decreases as the repair size category increases. The cost of the initial repair was obtained by adding the collision deductible to the paid claim amount.

Table 2 displays the results obtained after aggregating the results from the 35 individual vehicle series within combinations of type of construction, body style, and vehicle size. The results in Tables 1 and 2 do not indicate that the experience of unibody cars subsequent to a crash is any worse than that of frame cars. Taking into account all initial claims, Table 2 shows that the increases for unibody cars ranged from 20 to 60 percent and those for frame cars from 36 to 40 percent. Results based on the magnitude of original repairs yield similar conclusions — repaired unibody cars do not have relatively higher collision claim frequencies than repaired frame cars.

Figure 1 compares the increases in collision coverage claim frequencies for repaired, two-door unibody and frame cars based on the size of the original repair. The range of the average relative increase (1.0 standard deviation) is also presented to illustrate the variability of the individual vehicles' results when combining across vehicle size class. Figure 1 also shows that there are not significant differences in the increases in collision coverage claim frequencies for two-door unibody and frame cars that have been insured following a collision claim.

Figures 2 and 3 present similar comparisons for four-door and sports and specialty models and yield identical conclusions.

The results of this study provide no support for the hypothesis that repaired unibody cars are more likely to be involved in crashes than repaired frame cars.

TABLE 1
Increases in Collision Coverage Claim Frequencies For 1981-82 Model Year Cars After a Collision Repair

Body Style & Construction Type	Make/Series	Exposure For Repaired Cars	Claim Frequency For All Cars*	Percentage Increases In Claim Frequency For Repaired Cars		
				Size of Initial Repair		
				All	> $500	> $1000
TWO-DOOR						
Unibody	Chevrolet Chevette	2033	8.5	31	27	16
	Ford Escort	2464	8.2	33	28	2
	Ford Mustang	2372	9.2	10	7	4
	Honda Civic	1524	9.2	50	48	40
	Toyota Celica	2069	11.3	29	27	12
	Toyota Corolla	2547	11.3	27	19	19
Frame	Buick Regal	1770	8.5	34	34	19
	Oldsmobile Cutlass	2376	8.9	42	52	42
FOUR-DOOR						
Unibody	Chevrolet Chevette	2436	8.0	59	51	45
	Chevrolet Citation	1451	7.4	91	76	45
	Honda Accord	1135	8.6	14	31	-17
SPORTS & SPECIALTY						
Unibody	Chevrolet Camaro	2945	12.1	25	16	9
	Pontiac Firebird	1433	12.3	35	27	4
Frame	Chevrolet Monte Carlo	1514	8.8	33	33	35
	Pontiac Grand Prix	1258	9.0	39	31	21

* Results are taken from HLDI Reports R83-2 and R84-2 for model years 1981 and 1982, respectively.

TABLE 2
Increases in Collision Coverage Claim Frequencies
By Vehicle Size Class and Body Style
For 1981-82 Model Year Cars After a Collision Repair

Body Style & Construction Type	Vehicle Size Class	Exposure For Repaired Cars	Claim Frequency For All Cars*	Percentage Increases In Claim Frequency For Repaired Cars		
				Size of Initial Repair		
				All	> $500	> $1000
TWO-DOOR						
Unibody	Small	13713	9.9	32	25	20
	Midsize	3614	9.0	20	13	13
Frame	Midsize	4146	8.7	39	45	32
FOUR-DOOR						
Unibody	Small	5913	8.2	52	48	34
	Midsize	3408	7.9	60	49	41
Frame	Midsize	1401	7.3	40	45	67
SPORTS & SPECIALTY						
Unibody	Midsize	4378	12.2	27	19	7
Frame	Midsize	2772	8.9	36	31	28

* These results are derived from HLDI Reports R83-2 and R84-2 for model years 1981 and 1982, respectively.

FIGURE 1
Increases in Collision Coverage Claim Frequencies
After a Collision Repair — Unibody vs. Frame
1981-82 Two-Door Models

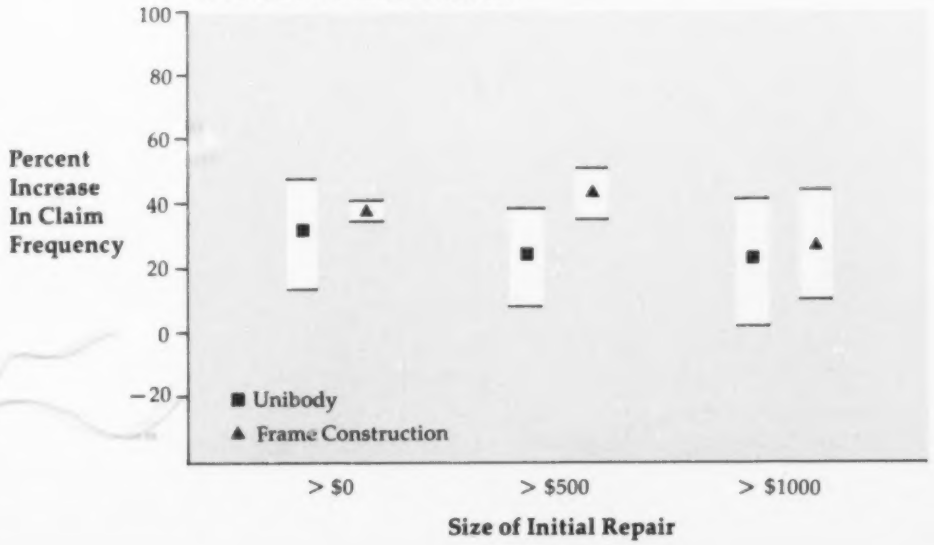


FIGURE 2
Increases in Collision Coverage Claim Frequencies After a Collision Repair — Unibody vs. Frame 1981-82 Four-Door Models

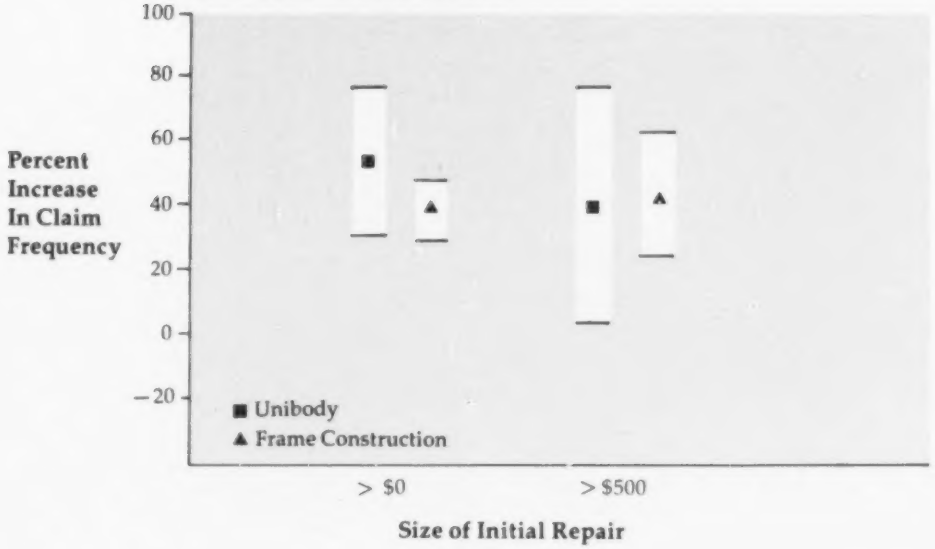
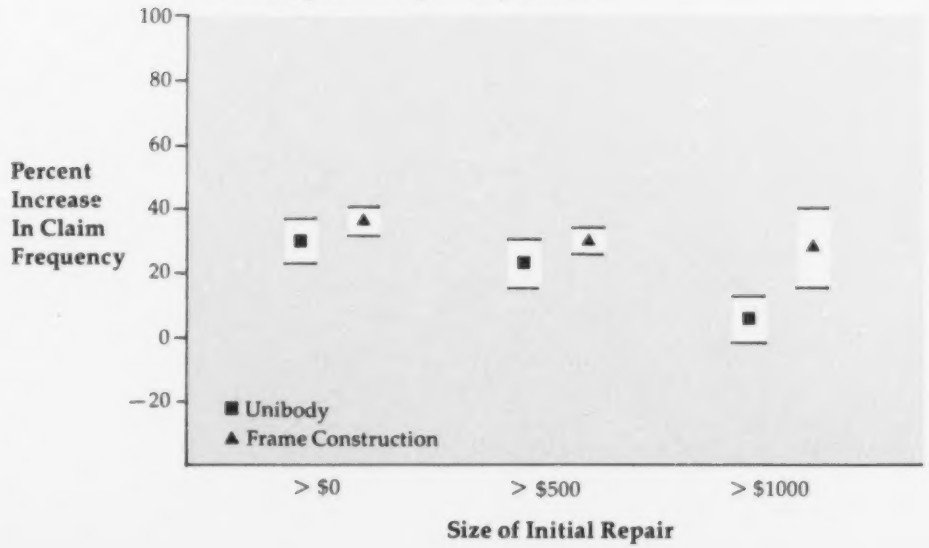


FIGURE 3
Increases in Collision Coverage Claim Frequencies After a Collision Repair — Unibody vs. Frame 1981-82 Sports & Specialty Models



APPENDIX A Selected 1981-82 Vehicles

Body Style & Construction Type	Vehicle Size Class	Vehicle Series	Model Year(s)
TWO-DOOR			
Unibody	Small	Chevrolet Chevette	1981, 1982
		Datsun 200SX	1982
		Datsun 210	1981
		Ford Escort	1981, 1982
		Honda Accord	1981, 1982
		Honda Civic	1981, 1982
		Toyota Celica	1981, 1982
		Toyota Corolla	1981, 1982
		Toyota Corolla Tercel	1982
	Midsize	Chevrolet Cavalier	1982
		Chevrolet Citation	1981
		Ford Mustang	1981, 1982
Frame	Midsize	Buick Regal	1981, 1982
		Oldsmobile Cutlass	1981, 1982
FOUR-DOOR			
Unibody	Small	Chevrolet Chevette	1981, 1982
		Ford Escort	1982
		Honda Accord	1981, 1982
		Plymouth Horizon	1981
		Toyota Corolla Tercel	1982
		Volkswagen Rabbit	1981, 1982
	Midsize	Buick Century	1982
		Buick Skylark	1981, 1982
		Chevrolet Cavalier	1982
		Chevrolet Celebrity	1982
		Chevrolet Citation	1981, 1982
		Oldsmobile Ciera	1982
Frame	Midsize	Buick Century	1981
		Chevrolet Malibu	1981
		Oldsmobile Cutlass	1981, 1982
	Large	Oldsmobile Delta 88	1981, 1982
		Oldsmobile Ninety Eight	1982
SPORTS & SPECIALTY			
Unibody	Midsize	Chevrolet Camaro	1981, 1982
		Pontiac Firebird	1981, 1982
Frame	Midsize	Chevrolet Monte Carlo	1981, 1982
		Pontiac Grand Prix	1981, 1982

APPENDIX B Standardization

Insurance loss experience varies with certain nonvehicle factors. With respect to collision coverages, two such important factors are the deductible amount of the coverage and the operator age group. In the case of operator age group, youthful operators generally generate higher insurance losses than older drivers. Thus, the proportions of youthful operators must be taken into consideration in comparing the loss experience of different vehicles. Results obtained from the two deductible categories, less than $150 and greater than or equal to $150, also vary. Again, if compared vehicles have different proportions of lower deductible coverages, this difference, if not taken into consideration, would also be sufficient to bias the comparison.

To remove any biases that could result because of variations among different vehicles in deductible amount and operator age group, the collision coverage results for the vehicles in this study were adjusted, or standardized, to produce a weighted average of actual results. The weights used in the standardization procedure are shown to the right.

Deductible	Youthful Operator	Nonyouthful Operator
< $150	.05	.50
≥ $150	.05	.40

Standardizing for these nonvehicle factors ensures that their mix is the same for each result. Therefore, to the extent that age distributions within each operator age group and amounts within each deductible group do not vary substantially for different vehicles, these effects will not bias comparisons among the various results.

The standarization procedure employed is widely used in health statistics.* The basic principle of the method is the introduction of a selected population with a standard distribution across the combinations of operator age group and deductible amounts, as represented by the standardization weights in the above table.

APPENDIX C Definitions

Claim Frequency — The number of claims for a group of vehicles, divided by the exposure for that group; expressed as claims per one hundred insured vehicle years.

Collision Coverages — As defined in insurance contracts, the coverage under which people insure their own vehicle against loss caused by collision.

Deductible Amount — That portion of the collision damage cost borne by the policyholder. For computing results, deductible amounts are split into two groups; less than $150 (mainly $50 and $100 deductibles) and greater than or equal to $150 (mainly $200 and $250 deductibles).

Exposure — The time interval an individual vehicle is insured. Exposure for a group of vehicles is expressed in units of insured vehicle years.

Loss Payment — That portion of the collision damage cost borne by the insurer; in general, the total collision damage cost minus the deductible amount.

Operator Age Group — The factor which distinguishes those vehicles whose rated driver is youthful from those vehicles whose rated driver is not youthful (see Youthful Operator).

Rated Driver — The driver who, for insurance purposes, is considered to represent the greatest loss potential for the insured vehicle.

Vehicle Size Class — There are four major body style groupings of passenger vehicles — regular two-door models, regular four-door models, station wagons and passenger vans, and sports and specialty models. Sports and specialty models include all two-seater cars, all convertibles, all midsize and large cars with two or fewer designated rear seating positions, and all luxury cars. All vehicles are divided into size classes based on wheelbase (rounded to nearest inch) defined as follows:

Small — Vehicles with wheelbases less than or equal to 99 inches.

Midsize — Vehicles with wheelbases greater than 99 inches and less than or equal to 109 inches.

Large — Vehicles with wheelbases greater than 109 inches.

Vehicle Identification Number (VIN) — A code, variously comprising both numbers and letters; normally, 8 to 17 characters in length, assigned to each vehicle by its manufacturer. The VIN uniquely identifies the vehicle within at least a ten-year span and, in recent model year vehicles, contains coding which identifies the make, series, model year, and other characteristics of each vehicle.

Vehicle Series — A name denoting a family of vehicles, within a make, with the same wheelbase and a degree of commonality in construction such as body, chassis, etc.

Youthful Operator — For the purposes of this report, all males (married or single) under 25 years of age and all unmarried females under 25 years of age.

*For example, see Armitage, P. *Statistical Methods in Medical Research*, Wiley, New York (1971).

HLDI Publications

Research reports published by the Highway Loss Data Institute are:

R72-1 *Automobile Insurance Losses, Collision Coverages; Variations by Make and Series, 1972 Models,* June 1973.

R73-1 *Automobile Insurance Losses, Collision Coverages; Initial Results for 1973 Models Compared with 1972 Models,* September 1973.

R73-2 *Automobile Insurance Losses, Collision Coverages; Variations by Make and Series, 1973 Models,* March 1974.

R73-3 *Automobile Insurance Losses, Collision Coverages; Variations by Make and Series, 1973 Models During Their First Two years,* December 1974.

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R80-2 *Automobile Insurance Losses, Collision Coverages; Variations by Make and Series, 1980 Models During Their First Year, 1979 Models During Their First Two Years, 1978 Models During Their First Three Years,* December 1980.

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R82-1 *Automobile Insurance Losses, Collision Coverages; Initial Results for 1982 Models,* July 1982.

R82-2 *Insurance Losses, Collision Coverages; Passenger Cars, Vans, Pickups, and Utility Vehicles; 1982 Models During Their First Year, 1981 Models During Their First Two Years; 1980 Models During Their First Three Years,* December 1982.

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R84-1 *Automobile Insurance Losses, Collision Coverages; Initial Results for 1984 Models,* June 1984.

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A-2 *Automobile Insurance Losses, Collision Coverages; Relationships Between Losses and Vehicle Density, 1972 and 1973 Models,* September 1974.

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A-5 *Automobile Insurance Losses, Collision Coverages; Relationships Between Losses and Vehicle Body Style, 1974 and 1975 Models,* December 1975.

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A-7 *Automobile Insurance Losses, Collision Coverages; Annual Increases and Seasonal Variations 1972, 1973, 1974 and 1975 Models,* June 1976.

A-8 *Automobile Insurance Losses, Injury Coverages; A Preliminary Comparison of Results for Volkswagen Rabbits with Passive and Active Seat Belts, 1975 and 1976 Models,* June 1977.

A-9 *Automobile Insurance Losses, Collision Coverages; A Comparison of Collision Claim Size Distributions for 1974, 1975, and 1976 Models,* November 1977.

A-10 *Automobile Insurance Losses, Injury Coverages; Comparisons of Claim Frequencies of Volkswagen Rabbits with Automatic and Manual Seat Belts, 1975, 1976, and 1977 Models,* June 1979.

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A-19 *Insurance Losses, Theft Coverages; A Comparison of the Theft Loss Experience of General Motors Passenger Cars With and Without Factory-Installed Theft Deterrent Systems; 1980-1981 Models,* January 1983.

A-20 *Insurance Losses, Collision Coverages, A Comparison of the Collision Loss Experience of Subaru Models with 5 and 2.5 MPH Bumpers,* April 1983.

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T81-1 *Insurance Losses, Theft Coverages; Passenger Cars, Vans, Pickups, and Utility Vehicles; 1981 Models During Their First Year, 1980 Models During Their First Two Years, 1979 Models During Their First Three Years*, May 1982.

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